

L E S S O N 2

Examining Sources

THINKING FOCUS

How do archaeologists investigate ancient cultures?

Key Terms

- archaeology
- excavation
- radiocarbon dating

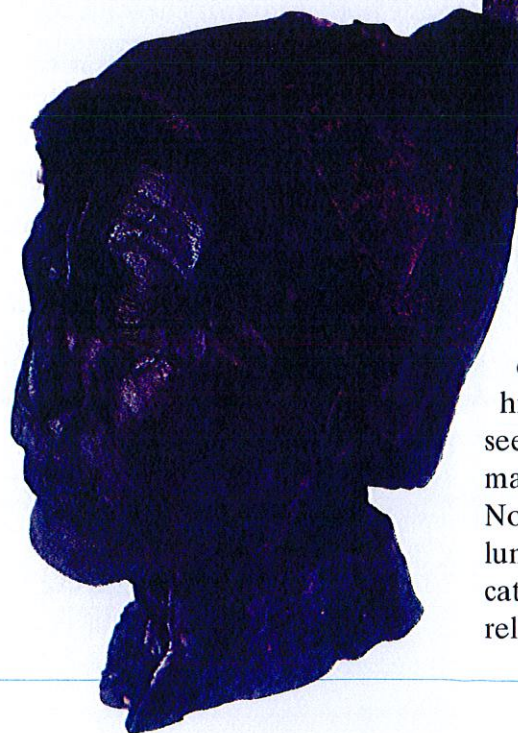
➤ *Tollund man was found in a Danish peat bog like the one shown here. After scientists determined what Tollund Man ate for his last meal, they prepared a similar meal of seeds and grain. The resulting mixture tasted quite bitter.*

The dead man lay on his side in a swampy area called a peat bog. His face was so calm that he appeared to have died in his sleep. But it was clear that he hadn't; a rope was wound tightly around his neck.

Two Danish workers discovered the man's body in 1950. They had come to Tollund Bog to cut peat, a form of rotted plant material that is used for fuel. The peat cutters wondered if they should call the police. As it turned out, the body in the bog was hardly a case for the Danish police. Instead, it was a lucky find for archaeologists. **Archaeology** is the recovery

and study of artifacts, ruins, bones, and fossils remaining from the past.

In Denmark, archaeologists soon learned that Tollund Man hadn't been hanged and buried that day, that year, or even this century. The airtight peat bog had perfectly preserved Tollund Man's body for thousands of years. Using a technique called radiocarbon dating, archaeologists found out



that the man had died around 210 B.C. Using other scientific techniques, they even found out what Tollund Man ate for his last meal: cereal, made with seeds of plants that grew in Denmark more than 2,000 years ago. No one can say for sure why Tollund Man died. But evidence indicates he may have been killed in a religious ritual.

Unlocking the Archaeological Record

Airtight peat bogs like the one at Tollund have preserved many other things, too. Archaeologists have found many things in the bogs such as parts of ancient horse-drawn carriages, plows, canoes, and weapons.

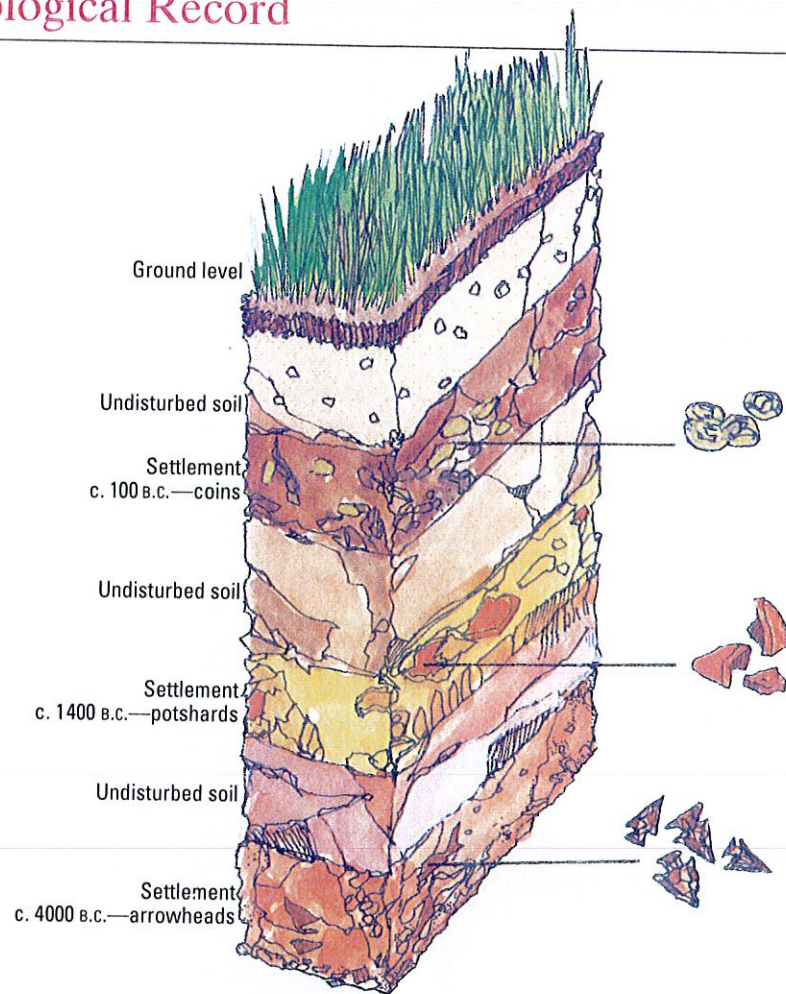
The artifacts, ruins, bones, and fossils that archaeologists discover and study make up the archaeological record. By studying the archaeological record, archaeologists can learn many things about people of the past: how they lived, what they ate, what diseases they had, and even how they died.

The Formation of the Record

Imagine a village where no one has lived for thousands of years. Over the centuries the wind and rain have swept through its streets, destroying many of its buildings. Eventually, all that is left of the village are the ruins of the buildings and a few artifacts. As more time passes, soil covers the site. Trees and brush grow over the remains. The archaeological record of the village becomes sealed in layers within the earth.

Centuries later, however, signs of the village may be brought back to the earth's surface. This uncovering occurs in many ways. Erosion, the gradual wearing away of soil, might reveal the remains of the ruined buildings. Animals rooting in the ground might dig up artifacts. New settlers clearing the land for farming might uncover more evidence.

Archaeologists then are able to examine the surface of the site and can begin to put together the archaeological record. In most cases,



however, evidence remains buried in layers in the earth, and archaeologists must use excavation to examine the site. **Excavation** is the process of digging up the remains of the past.

The Excavation of a Site

Once archaeologists have located a site, they carefully remove the earth, layer by layer. They divide the surface of the site into squares with grids. As they dig, they carefully record the exact location of every object they find.

The study of the remains that are found in various layers of soil and rock is called stratigraphy (*struh TIHG ruh fee*). Studying the layers themselves, as well as the

▲ Modern archaeologists place grids horizontally over a site and even vertically as they excavate. This helps them record the location of artifacts in the layers.

artifacts, can give archaeologists clues about how the archaeological record was formed at different periods in history.

Some areas of the world have been inhabited for thousands of years. In these areas, many groups of people have built cities on top of the ruins of earlier cities. For example, archaeologists have found evidence of at least seven cities built on top of each other at the site of ancient Troy in modern-day Turkey.

■ *What is the archaeological record?*



Compare United States currency with these Roman coins. What would a historian of the future learn about you from your pocket change?



How can archaeologists find out how old an artifact might be? They use two methods, cultural dating and scientific dating.

Cultural Dating

Suppose you are taking part in an archaeological dig in Italy, where the Roman Empire flourished 2,000 years ago. As you carefully sift through one layer of soil, you find a small object. When you clean it off, you discover that it is a metal coin. It's decorated with the portrait of a man, but it does not have a date on it. How would you go about finding out how old it is?

A little research about the Roman Empire from written sources will tell you about the history of Roman coins.

Coins were decorated with the face of the emperor who was in power when the coin was made. Some research into Roman art will lead you to sculptures and portraits of Roman emperors. You might find out that the emperor

In general, archaeologists believe that the deepest layers are the oldest. However, this may not always be true. Over time, new cultures disturb the layers by digging up soil and artifacts from deeper layers. Shifts in the earth's crust, such as earthquakes, can also disturb the layers. Therefore, things of different ages may be buried together. In such cases, archaeologists must use other techniques to date the layers and the objects found in them. ■

pictured on the coin you uncovered is Augustus. You then learn that he ruled from 31 B.C. to A.D. 14. Now you know that the coin you found was made between 31 B.C. and A.D. 14.

This process of gathering information is an example of cultural dating. Archaeologists are using cultural dating when they compare objects they find with information they already have. To find the date of the Roman coin, for example, you compared it with information you could get about Roman coins and emperors.

Absolute and Relative Dating

Archaeologists use two types of cultural dating: absolute dating and relative dating. With absolute dating, archaeologists decide the age in years of an object. Finding the date of the Roman coin is an example of absolute dating.

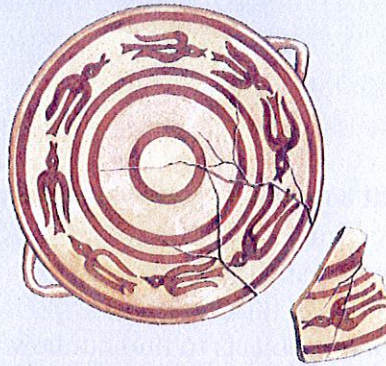
However, archaeologists cannot always find out exactly how old an object is. Sometimes, they can only find out whether it is older or newer than other objects. This is called relative dating.

Using Pottery to Date Archaeological Finds



The shard and amphora, or wine jug, have similar patterns scratched on their surfaces. So the shard probably dates to the same period as the amphora, from 3000 to 2000 B.C.

The bird on the shard below is similar to those found on the bowl. So the shard probably dates to the same period as the bowl, from 1450 to 1100 B.C.



The portion of the animal shown on the shard is similar to the animals on the vase. Also, both shard and vase have a shiny finish. The shard probably dates to the same period as the vase, the 1200s B.C.



◀ Archaeologists rarely find complete pots. More often, they find shards, or broken pieces of pottery like the one below. To establish the date of the shard, they compare it to similar pots that have already been dated. The chart at left shows three examples of potshard dating.



Pottery is an important tool in relative dating. Pottery was very common in early cultures and so it is often found in excavations. Because pottery styles changed a great deal over time, archaeologists can identify different pottery styles. They can determine which styles were developed first and which came later. Using this information, archaeologists can then decide the relative age of other objects found at the same site as the pottery.

Scientific Dating

Some ancient objects can be dated more accurately by analyzing them in a laboratory. This kind

of analysis is called scientific dating. The oldest form of scientific dating is dendrochronology (*dehn droh kruh NAHL uh jee*), or tree-ring counting. It has been used since the 1700s.

Dendrochronology is based on the fact that a tree grows a new ring every year. So, you can figure out the age of a tree by counting the number of rings in its trunk. In addition, changes in the climate, including temperature and rainfall, affect a ring's thickness, so trees in one area have a specific pattern of rings.

Archaeologists compare tree-ring patterns from many trees and piece together a master pattern

▼ Which method would you use to date each of the following objects—a fossil trilobite, a prehistoric sea animal; a bone from a prehistoric human; and a wooden sculpture from ancient Peru?



Determining the Age of Archaeological Finds

Method	Age Range	Process
Written records	Up to about 5,000 years ago	Use written records of known age to date artifacts found along with them.
Tree-ring dating	Up to about 8,000 years ago	Match the pattern in a wooden object to a master tree-ring pattern; count the rings.
Radiocarbon dating	From about 1,000 to 60,000 years ago	Measure the amount of radioactive carbon remaining in the object (used to date the remains of plants and animals).
Potassium-argon dating	More than 500,000 years ago	Compare the amounts of potassium and argon present in volcanic rock (used to date bones and tools found in the rock).

that covers a period of many hundreds of years. Then the archaeologists match the pattern of the rings with the pattern in ancient wooden objects to find out how old the objects are.

Radiocarbon Dating

Archaeologists have developed many other scientific dating techniques. The most significant is **radiocarbon dating**. In this method, the radioactive carbon within an archaeological discovery is measured to determine the age of the object. Radiocarbon dating can only be used to date the remains of once-living things, such as wood or bones.

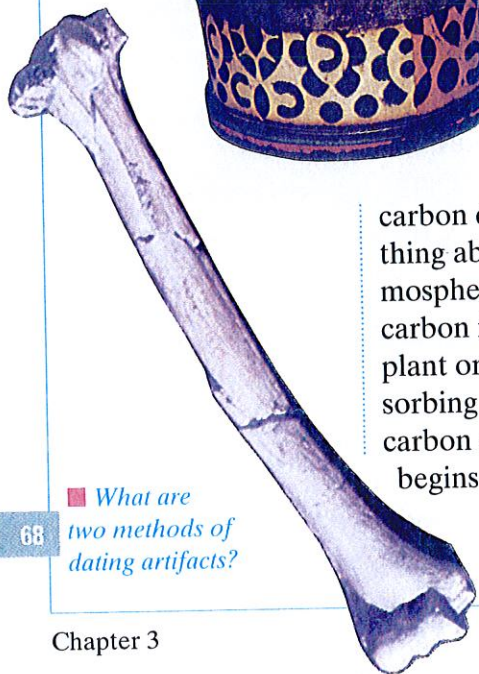
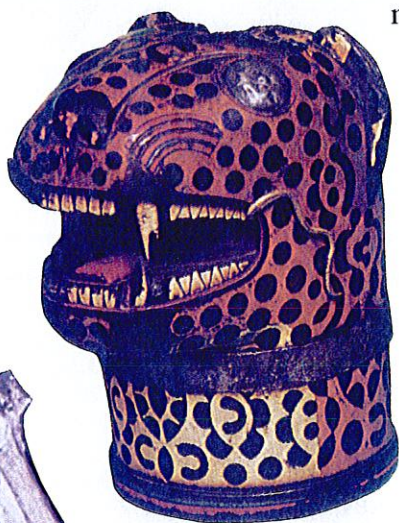
Here's how radiocarbon dating works. Every living thing absorbs carbon from the atmosphere. A small amount of the carbon is radioactive. When a plant or animal dies, it stops absorbing carbon. The radioactive carbon absorbed when it was alive begins to decay at a known rate.

Archaeologists have figured out methods of

measuring the amount of radioactive carbon left in things like bones and wood. Using this information, they can figure out when a plant or animal died. They can even figure out how long ago the tree used to make an artifact lived.

Radiocarbon dating has helped solve many mysteries. For example, in 1950 archaeologists used this method to figure out the age of Tollund Man. But radiocarbon dating is not perfect. It does not work on objects less than 1,000 years old or more than 60,000 years old. In addition, the accuracy of radiocarbon dating can be affected by pollution. Even the smoke from a cigarette can affect the accuracy of a sample.

In spite of these problems, radiocarbon dating has had a great impact on archaeology. For one thing, it has forced archaeologists to rethink some of their ideas about the past. For example, archaeologists used to believe that the great pyramids in Egypt were the oldest stone monuments in the world. However, radiocarbon dating of objects within the tombs has proved that giant stone tombs found in western Europe were built hundreds of years before the pyramids. ■



■ What are two methods of dating artifacts?



Interpreting the Evidence

Techniques such as radiocarbon dating have given archaeologists valuable information about the past. Nevertheless, people can interpret the archaeological record in many ways. Archaeologists must interpret the evidence they collect just as historians do.

People tend to interpret past events in light of their own experiences. For example, imagine you are on an archaeological dig and you come upon a row of stones. You might assume the stones are part of a wall, because you are familiar with stone walls. However, the people of an ancient culture might have brought these stones together for other reasons. Perhaps they were trying to create an altar to their god or to keep track of lunar eclipses.

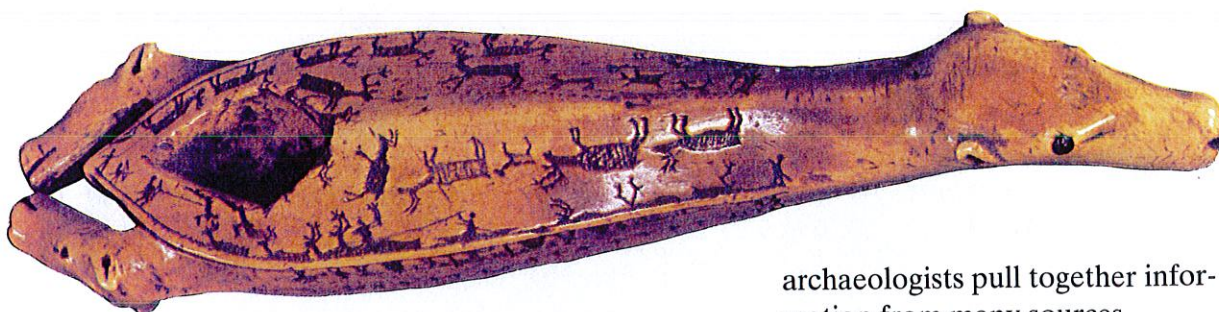
Reconsidering the Past

As different archaeologists examine the archaeological record, they come to different conclusions about its meaning. For example, archaeologists disagree about the meaning of objects depicted in ancient cave art. These paintings were made by humans more than



▲ This cave painting from Lascaux, France, is 17,000 years old.

◀ At left is a detail from the cave painting above. Some think the object shown is a spear; others identify it as a stalk of wheat. What do you think?



▲ Examine the object above. It is made of bone and engraved with caribou designs. What do you think it is? Archaeologists have identified it as an arrow straightener, a tool used by prehistoric hunters.

How Do We Know?

HISTORY Archaeologists conduct experiments to help them interpret the archaeological record. For example, they sometimes construct replicas of ancient buildings to observe how they decay. They even study garbage to find out what kinds of things people throw away.

■ Why do archaeologists reach different conclusions about the past?

10,000 years ago. Some archaeologists believe the objects are weapons such as arrows, spears, and harpoons. If they are, it would indicate that early humans were hunters and warriors.

In recent years, however, some people have begun to challenge that interpretation. A scholar named Alexander Marshack, for example, used a microscope to examine these works of art closely. Marshack decided that the objects depicted in these early paintings might be plants, tree branches, and leaves instead of weapons. He believes the artwork may celebrate nature, not hunting. Perhaps our early ancestors were not as warlike as archaeologists have long believed.

Interpreting the Past

Archaeologists must use all the evidence they can gather to interpret the archaeological record. The case of Tollund Man shows how

archaeologists pull together information from many sources.

Through radiocarbon dating, they were able to find out that the man in the peat bog died in about 210 B.C. But how and why did he die?

To find out, archaeologists had to do more research. From written records, they learned that the ancient Nordic people sometimes sacrificed people to their gods by hanging them. The archaeologists even learned that the food Tollund Man ate for his last meal might have been a part of the ritual of the sacrifice. Although archaeologists still cannot be sure, they think that Tollund Man was hanged, not as a punishment but as an offering to the gods.

Perhaps future generations of archaeologists will find additional information about Tollund Man. Future generations also might interpret the information that is already available differently. For archaeologists as well as for historians, interpreting the evidence is a never-ending process. ■

R E V I E W

Please answer the following questions on a separate sheet of paper *in complete sentences*.

1. How do archaeologists investigate ancient cultures?
2. Why do archaeologists need to pay attention to the layers in the dirt they remove?
3. Pick four modern artifacts, for example, a coin, a tool, a wooden object, and a piece of pottery. Examine each artifact and then list the method you would use to determine its date and why.